

Status Survey of the Southeastern Shrew (*Sorex longirostris*) in Arkansas

Several works have highlighted that there is a paucity of information regarding the Southeastern Shrew (*Sorex longirostris*) in Arkansas and that this species is in need of immediate study. To this end, we propose to develop a habitat profile, from eight existing records of the southeastern shrew, and then determine if this species is found in suitable habitats in surrounding ecoregions located in the interior highlands. We further plan to ascertain if the shrew can be found in the Crowley's Ridge and eastern Mississippi Alluvial Plain ecoregions. If they can be documented in these regions, it would demonstrate that there is not such a large gap in the known Arkansas population or species' geographical range. If in fact this species does not occur in eastern Arkansas or it is found in eastern and western Arkansas but a gap in distribution remains this provokes interesting questions regarding adaptive radiation to varied habitats, taxonomic status, range extensions and dispersal of a small, relatively short-lived thus not highly mobile species.

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Amount and Sources of Grant:

Arkansas Game and Fish Commission Contribution	\$ 40,041 (49.1%)
University of Arkansas at Little Rock Match	\$ 41,464 (50.9%)

Total \$ 81,505

Problem:

The southeastern shrew (*Sorex longirostris*) is native to the southeastern United States (Nowak, 1991). French (1980) stated that detailed information on presence and abundance of this species is especially lacking west of the Mississippi river including Arkansas, which is the southwestern extreme of the geographical range. In a state-wide shrew study, Garland and Heidt (1989) indicated that *S. longirostris* is uncommon and Sealander and Heidt (1990) point out the species should be considered a mammal of special concern in Arkansas because the species is at the geographic limit of its range and there are few records of occurrence from 8 counties (Benton, Washington, Madison, Newton, Stone, Perry, Polk and Pike) confined to the interior highlands (Sealander and Heidt 1990), which contain the Ozark Mountain, Boston Mountain, Arkansas River Valley, and Ouachita Mountain ecoregions.

While basic life history information is needed to understand and conserve this species in Arkansas, data from the state's population may have another significant value because Arkansas constitutes the periphery of the species' range and possibly suboptimal habitat. In addition, if the Arkansas population only occurs in the above ecoregions then lack of occurrence in eastern Arkansas represents a gap in the species distribution. These are questions of fundamental importance for understanding adaptive radiations, dispersal, and range extensions.

Funding Priority and Species of Greatest Conservation Need:

Given the scarcity of information in Arkansas, the Arkansas Natural Heritage Commission designated *S. longirostris* as an S2 species and the State Wildlife Action Plan Steering Committee determined that the species is a conservation priority. The committee declared, due to a lack of data, implementation of a status survey and gave the species a priority ranking of two out of ten with one being the highest need for action.

Our survey methods could provide information for a variety of species that have been identified as having the greatest conservation need in Arkansas, including five that are ranked as S1 and six as S2. In the Mississippi Valley Loess Plains and Mississippi Alluvial Plain ecoregions these species include the Southern Bog Lemming (*Synaptomys cooperi*), Western Harvest Mouse (*Reithrodontomys megalotis*), Eastern Harvest Mouse (*Reithrodontomys humulis*), Spotted Dusky Salamander (*Desmognathus conanti*), Northern Crawfish Frog (*Rana areolata circulosa*), Eastern Spadefoot (*Scaphiopus holbrookii*), Midwest Worm Snake (*Carphophis amoenus helenae*), and Graham's Crayfish Snake (*Regina grahamii*). In the Ozark Highlands, Boston Mountains, Arkansas Valley and Ouachita Mountains ecoregions potential data could also be collected for the Desert Shrew (*Notiosorex crawfordi*), Plains Harvest Mouse (*Reithrodontomys montanus*), Fourche Mountain Salamander (*Plethodon fourchensis*), Caddo Mountain Salamander (*Plethodon caddoensis*), Great Plains Narrowmouth Toad (*Gastrophryne olivacea*) and Graham's Crayfish Snake (*Regina grahamii*).

Ecoregions and Conservation Priority:

This project will be conducted in the interior highlands (Arkansas Valley, Ozark, Boston, and Ouachita Mountain ecoregions), the Mississippi Valley Loess Plains, including Crowley's Ridge, and the eastern Mississippi Alluvial Plain ecoregions. It will address status and gaps in distribution of the southeastern shrew in Arkansas by evaluating habitat and microhabitat preferences with the assistance of GIS.

Goals:

(1) We plan to profile the eight known interior highland localities of *S. longirostris* with the goal of being able to predict habitat for the species in Arkansas.

(2) After completing a habitat profile, we will then sample related habitats to evaluate presence in other areas of the interior highlands.

(3) At the present time, the overall distributional range of *S. longirostris* includes the Mississippi Alluvial Plain and Crowley's Ridge ecoregions. Although specimens have been captured in Shelby County, TN and along the Mississippi River in Mississippi, there are no records from extreme eastern Arkansas. Thus, there is a major gap in the distribution of this species in Arkansas. It has even been speculated that the individuals in the interior highlands represent a disjunct population from the populations east of the Mississippi River. Therefore, we plan to sample Crowley's Ridge and the extreme eastern portion of the Mississippi Alluvial Plain in an attempt to document this species from those areas and examine if the apparent gap is an ecological reality.

(4) Because Arkansas represents the extreme southwestern range of this species, any differences we discover between populations may provide information concerning adaptation to potentially suboptimal habitat. Consequently, we plan to evaluate data with the goal of gaining insight concerning how species adapt to marginal environments.

(5) An added benefit is that, as is true of most species of small, non-game animals, relatively minor changes in land-use patterns can profoundly alter distribution and health of populations and rank among the most cost-effective of management plans. Unfortunately, we have so little information on *S. longirostris* in Arkansas that any conservation efforts are at best a guess. This study will provide these base line data and additional, valuable life history information that is currently lacking and potentially specimens for future studies.

Methods and Approaches:

The southeastern shrew is easily distinguished from the other Arkansas soricids. It has a long (one-third of total length), indistinctly bicolored tail. In addition, it has five unicuspid teeth in the skull, whereas the other species have three or four.

Two major techniques, trapping and dissection of owl pellets for skulls will be used to document the occurrence and distribution of *S. longirostris*. Trapping efforts will be conducted with a combination of custom-made, shrew-sized treadle traps, funnel traps, pitfalls, and shrew-sized Sherman traps in which trigger mechanisms have been modified to respond to lighter-than-normal pressures. The UALR Biology Department currently has enough of each trap type (with the possible exception of pitfalls and pitfall lids) to conduct the study. In a study on the status and distribution of the desert shrew (*Notiosorex crawfordi*) completed in 2005, the only successful trap was the pitfall. Further, during a previous study, the PI obtained two of the eight existing county records for the southeastern shrew in pitfalls. Thus, our major trapping efforts will be conducted with pitfalls set in five pitfall arrays interconnected by aluminum flashing drift fences. These traps offer a large number of trap nights and are easily placed over large areas. We will, however, use the other trap types as the southeastern shrew may respond differently than desert shrews and we will obtain data on other small mammal species.

Following the methods of previous small mammal surveys (Mengak and Guynn, 1987; Simons et al., 1990; Rosenblatt et al., 1999; Bellows et al., 2001), pitfalls, custom-made live traps and Sherman live traps will be operated for 3-5 consecutive nights and checked daily. Between uses, pitfalls will be made inoperable with snap-on lids, while custom-made and Sherman live traps will be removed. Living Soricids, except for *S. longirostris* and the Desert Shrew (*Notosorex crawfordi*), and living non-Soricids will be identified to species and released at the capture site. *S. longirostris* and *N. crawfordi* specimens, non-living specimens and those for which positive in-field identification can not be made will be collected, lab-identified and deposited into the University of Arkansas at Little Rock Vertebrate Museum.

Tissues and/or hair will be collected from each voucher specimen and stored for future systematic studies. This will be especially important if individuals within the interior highlands do represent disjunct population. In all field activities (e.g., live-trap lines, pitfall arrays, barn owl roosts, etc.) we will record GPS coordinates for further analysis and documentation.

Trapping will be done by one graduate assistant over a span of two years and will include a minimum of 90 man-days per year in the field during the period of maximum activity (summer). These collecting efforts will be supplemented by sampling during Christmas and Spring breaks and during the academic year as field experiences in appropriate classes to provide data for this study and additional training for undergraduate students in research and field techniques.

Analysis of owl pellets, particularly from the barn owl, has been proven to be an effective means for documenting small mammals: this was particularly true in the desert shrew project. We will re-examine the extensive set of owl pellets, from western Arkansas, used in the desert shrew project. In addition, we have a large set of pellets from the Crowley's Ridge area. Further, we will use newspaper ads to solicit pellets from other areas within the overall study area. Owl's forage within a small range, therefore any location in which a *S. longirostris* skull is found in an owl pellet will be a local epicenter for further examination to document occurrence.

This study will begin by revisiting the known localities of documented specimens. These areas will be re-trapped and microhabitat data will be collected. These data will be analyzed using Arkansas GAP, Geographical Information Systems (GIS), Global Positioning Systems (GPS), and the SAS statistical program in an effort to delineate other potential ecological areas where southeastern shrews may be found. These new areas will then be systematically examined and trapped in an attempt to document and collect new specimens.

Areas within the Crowley's Ridge and Mississippi Alluvial Plain will be selected based on GAP-predicted habitat types, most likely moist areas with a high amount of ground cover which this species seems to prefer. The same techniques used in the interior highland will be used in these sites. We will definitely sample areas in Arkansas that are within close proximity to Shelby County, TN and documented sites in northern Mississippi.

Measurable Products or Outcomes:

Data provided by this study will provide wildlife personnel with concrete information on current distribution, status, and habitat requirements for *S. longirostris* needed to formulate appropriate conservation plans for this rare species. Further, the study will provide a database and specimens for future studies on this species. An additional benefit of this study is that it will provide distributional records for a number of the non-target, small, poorly known species of mammals and hepatofauna in the state and data can be used to identify their preferred microhabitats as well. This study will also provide support and training for an Arkansas graduate student and a number of undergraduate students in biology and will facilitate further interactions between UALR and the Arkansas Game and Fish Commission. Copies of all presentations will be provided to Game and Fish in the form of a PowerPoint file.

To facilitate interest and future studies in conservation and in this species in particular, we commit to entering our monitoring methodology into the Natural Resource Monitoring Partnership database and updating the Comprehensive Wildlife Conservation Strategy database upon completion of the project, as well as to publicize the collaborative work in a forum appropriate for the general public.

Timetable:

Prior to Summer 2008:

Sample and profile eight known interior highland localities and analyze data from Arkansas GAP to identify additional areas of suitable habitat. Solicit for owl pellets from areas of interest.

By end of August 2008:

Completed first field season to sample GAP-indicated areas of suitable habitat.

Fall 2008:

Entering monitoring methodology into the Natural Resource Monitoring Partnership database. Progress report to AG&FC

By Mid-January 2008:

Additional field work at selected locations.

By end of Summer 2009:

Completed second field season.

Fall 2009:

Progress report to AG&FC and presentation to update scientific community.

By end of Fall 2009:

Thesis submitted to peer-reviewed journal(s) and update of Comprehensive Wildlife Conservation Strategy database. Publicize work in a forum appropriate for the general public.

Existing Resources:

Existing resources include, but are not limited to, laboratory and museum space and equipment, GIS facilities, GPS equipment with computer input capabilities, computers with modeling, statistical, and mapping software, traps and miscellaneous field equipment and a UALR van and trailer.

Personnel resources include the expertise of the PI and Co-PI (see below); expert colleagues in several collateral areas including but not limited to plant taxonomy, GIS, and molecular systematics, an active graduate program, a large number of enthusiastic undergraduate students and a supportive research-minded administration.

Proposed Budget:

	AG&FC Contribution	UALR Match	Total Grant
Contributions:	40,041 (49.1%)	41,464 (50.9%)	\$81,505

AG&FC Contribution

AMOUNT

Graduate RA Stipend* (16 months @ \$13,000/year)	\$17,506
Grad. Student Tuition (2 semesters @ \$1,908/9hr semester & \$688 fees)	4,504
Travel [†] (10,000 miles/year @ \$0.42/mile)	8,400
Local expenses (\$30 per diem for 180 man days in field)	5,400
Materials and supplies [§] (pit traps, flashing, veg. sampling)	1,000
Indirect costs (10%)	<u>3,231</u>
	\$40,041

UALR Match

5% time for PI* (22 months)	\$11,830
5% time for Co-PI* (22 months)	5,084
Graduate TA Stipend* (12 months)	8,080
Graduate student tuition (2 semesters @ \$1,908/9hr semester)	3,816
Travel for PI & Co-PI research trips with classes and student assistants	1,400
Existing trapping and field equip., storage facilities for voucher specimens	1,600
Computer and software	2,000
Unrecovered indirect costs (29%)	<u>7,654</u>
	\$41,464

Budget Justification

*Includes fringe (30% faculty; 1% grad. student)

[†]Travel expenses are calculated at 100 miles of travel per man-day on location (=18,000 miles) and an additional 2000 miles travel to and from target counties over two year period.

[§]Materials and supplies include costs for additional pit trap buckets, lids and flashing beyond that already existing at UALR, as well as bait, vegetation sampling materials and miscellaneous field supplies.

Qualifications of PIs and Organization:

Principle Investigator – Gary A. Heidt has worked with mammals in Arkansas for over 35 years. He has authored or co-authored over 125 articles, both peer reviewed and popular. He is co-author of “Arkansas Mammals: Their Natural History, Classification, and Distribution” and “Laboratory Experiences in Zoology”.

He completed the new Arkansas mammal status report for AG&FC and the Arkansas Heritage Commission. He has served on the AG&FC Non-game Committee since 2000.

In particular reference to this study, he has conducted a state wide shrew project (with an undergraduate student) resulting in two of the eight records for *S. longirostris*. He was co-PI on an AG&FC grant to determine the status and distribution of the desert shrew (*Notiosorex crawfordii*) in Arkansas. He was co-major professor for Stacie Thomas, the graduate student who conducted the study.

He has served as the Biology Department Chair (six years) and as the Acting Associate Dean for the College of Science and Mathematics. He has mentored numerous undergraduate and graduate research projects.

Co-Principle Investigator – David W. Clark has both academic training and practical field experience that qualifies him to conduct a shrew survey in Arkansas. He received Bachelors in Wildlife Biology from UALR in 1999 and a Masters in Biology, emphasizing ecology, from UALR in 2002. Currently, with sixteen months of experience, he is a full-time Biology Department Instructor with graduate faculty status at UALR. In this position, he has taught an assortment of field-oriented courses such as Wildlife Management Techniques, Principles of Wildlife Management, Vertebrate Zoology, Mammalogy and Herpetology. Additionally, as an instructor of these courses he has knowledge regarding identification, habitats and microhabitats, behavior, as well as capture methods and equipment specific to shrews.

His experience in field work and data collection, handling, and analysis includes a great variety of mammal work. These include an urban mammal survey, leading a state-wide search for mountain lion sign, involvement in two bear projects (trapping White River National Wildlife Refuge plus adjacent private lands and a suburban nuisance bear situation in Louisiana), participation in a nuisance river otter project in Missouri, involving operation of foothold traps and handling a variety of animals from mink, several semi-aquatic mammals to bobcats and directing a energetic study of captive river otters.

Involvement in these projects required him to work unsupervised, lead and instruct others, as well as work in group situations as a subordinate and equal. In addition, he has worked on projects requiring considerable travel in all weather conditions on both public and private lands; therefore, he understands the inherent nature of such endeavors and how individuals must conduct themselves to see multifaceted complex projects to completion.

G.A. Heidt and D.W. Clark – Status of *Sorex longirostris* in Arkansas

University of Arkansas at Little Rock Biology Department – The UALR Biology Department has a long and outstanding record in field-related activities. Many of our undergraduates have gone on to attain advanced degrees and many are teaching at excellent universities and are leaders in their field.

Since the inception, in 1999, of the M.S. degree we have graduated five ecology/field oriented students and have another five students currently enrolled. In addition, there is one student enrolled in the Applied Science Ph.D. program.

From the existing resources section, it can be seen that the department has excellent facilities and equipment.

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